CLAIMS

What is claimed is:

1. A method for classifying portions of an input measurement sequence into a plurality of regimes, comprising:

associating each of a plurality of dynamic models with one of a plurality of switching states such that a model is selected when its associated switching state is true;

determining a state transition record by determining and recording, for a given measurement of the sequence and for each switching state, an optimal prior switching state, based on the input sequence, wherein the optimal prior switching state optimizes a transition probability;

determining, for a final measurement, an optimal final switching state;

determining a switching state sequence by backtracking, from said optimal final switching state, through the state transition record; and

classifying portions of the input sequence into different regimes, responsive to the switching state sequence.

2. The method of Claim 1 wherein classifying depends upon conditions existing at the time the sequence was created.

3. The method of Claim 1 wherein regimes are motion regimes.

4. The method of Claim 3 wherein a motion is human motion.

5. The method of Claim 4, wherein human motion comprises at least one of walking, jogging, running, jumping, sitting, and climbing, and ascending and descending a staircase.

6. The method of Claim 4, further comprising:

identifying at least one specific individual based on observed dynamics of their motion in image sequences.

7. The method of Claim 6, wherein at least one specific individual is a criminal suspect.

8. The method of Claim 1, wherein classifying sequences into motions is used to conduct surveillance.

9. The method of Claim 8, wherein a motion comprises at least one of opening a door or dropping a package.

10. The method of Claim 1, wherein at least one constraint is imposed on classification.

11. The method of Claim 1, wherein each motion is an individual sign of a sign language

12. The method of Claim 1, wherein classification of a motion serves as input to a computer user interface

13. The method of Claim 1, wherein sets of dynamic models are used to model qualitatively different regimes of a trajectory with one temporal event.

14. The method of Claim 1, further comprising:
selecting key frames from the input sequence responsive to classifying; and
performing video compression by transmitting the selected key frames at a low sampling rate.

15. A classification system comprising:
a plurality of linear dynamic system (LDS) models, wherein at any given instance, one of the plurality of LDS models is selected responsive to a switching variable whose value at the given instance is one of a set of possible switching states;

a state transition recorder which determines, from an input sequence of measurements, a state transition record by determining and recording, for a given measurement and for each possible switching state, an optimal prior switching state, wherein the optimal prior switching state optimizes a transition probability, and which determines, for a final measurement, an optimal final switching state;

a backtracker which determines a switching state sequence by backtracking, from said optimal final switching state, through the state transition record, each regime being indicated by at least one switching state; and

a classifier which classifies portions of the input sequence into different regimes, based on SLDS parameters and responsive to the switching state sequence.

16. The system of Claim 15 wherein a motion is human motion.

17. The system of Claim 16, wherein human motion comprises at least one of walking, jogging, running, jumping, sitting, and climbing, and ascending and descending a staircase.

18. The system of Claim 16, further comprising:
an identifier which identifies at least one specific individual based on observed dynamics of their motion in image sequences.

19. The system of Claim 18, wherein at least one specific individual is a criminal suspect.

20. The system of Claim 15, wherein motion classification is used for conducting surveillance.

21. The system of Claim 20, wherein a motion comprises at least one of opening a door or dropping a package.

22. The system of Claim 15, wherein at least one constraint is imposed on classification.

23. The system of Claim 15, wherein the motions comprise individual signs of a sign language.

24. The system of Claim 15, wherein classification of a motion serves as input to a computer user interface

25. The system of Claim 15, wherein sets of dynamic models are used to model qualitatively different regimes of a trajectory with one temporal event.

26. The system of Claim 15, comprising:

a video compressor which performs video compression, responsive to the classifier.

27. The system of Claim 26, further comprising:

a transmitter which transmits key frames at a low sampling rate, wherein a receiver interpolates missing frames from transmitted model parameters.

28. A classification system for classifying an input measurement sequence, comprising:

means for associating each of a plurality of dynamic models with one of a plurality of switching states such that a model is selected when its associated switching state is true;

means for determining a state transition record by determining and recording, for each switching state, an optimal prior switching state, based on the input sequence, wherein the optimal prior switching state optimizes a transition probability;

means for determining, for a final measurement, an optimal final switching state;

means for determining a switching state sequence by backtracking, from said optimal final switching state, through the state transition record; and

means for classifying portions of the input sequence into different regimes, responsive to the switching state sequence.

29. A classification system for classifying an input measurement sequence, comprising:

a plurality of linear dynamic system (LDS) models, wherein at any given instance, an LDS model is selected responsive to a switching variable;

a switching model which determines values of the switching variable;

an approximate variational state sequence inference module, which reestimates parameters of each LDS model, using variational inference, to minimize a modeling cost of current state sequence estimates, responsive to at least one training sequence of measurements; and

a classifier which classifies portions of an input sequence into different regimes, based on the reestimated dynamic models.

30. The system of Claim 29 wherein classifying is responsive to conditions existing when the input sequence was created.

31. The system of Claim 29 wherein regimes are motion regimes.

32. The system of Claim 31 wherein a motion is human motion.

33. The system of Claim 32, wherein human motion comprises at least one of walking, jogging, running, jumping, sitting, and climbing, and ascending and descending a staircase.

34. The system of Claim 32 wherein at least one specific individual is identified based on observed dynamics of their motion in image sequences.

35. The system of Claim 29, wherein sequences are classified into motions for surveillance purposes.

36. The system of Claim 29, wherein at least one constraint is imposed on classification.

37. The system of Claim 29, wherein sets of dynamic models are used to model qualitatively different regimes of a trajectory with one temporal event.

38. The system of Claim 29, comprising:
a video compressor which performs video compression, responsive to the classifier.

39. The system of Claim 38, further comprising:
a transmitter which transmits key frames at a low sampling rate, wherein a receiver interpolates missing frames from transmitted model parameters.

40. A system for classifying portions of an input sequence of measurements into a plurality of regimes, given a set of possible switching states, comprising:
means for associating each of a plurality of dynamic models with a switching state such that a dynamic model is selected when its associated switching state is true, wherein the switching state at a particular instance is determined by a switching model;
means for decoupling the dynamic model from the switching model;
means for determining parameters of the decoupled dynamic model, responsive to a switching state probability estimate;
means for estimating a state of the decoupled dynamic model corresponding to a measurement at the particular instance, and responsive to the input sequence;

means for determining parameters of the decoupled switching model, responsive to the dynamic state estimate;

means for estimating a probability for each possible switching state of the decoupled switching model;

means for determining a switching state sequence based on the estimated switching state probabilities; and

means for classifying portions of the input sequence into different regimes, responsive to the determined switching state sequence.